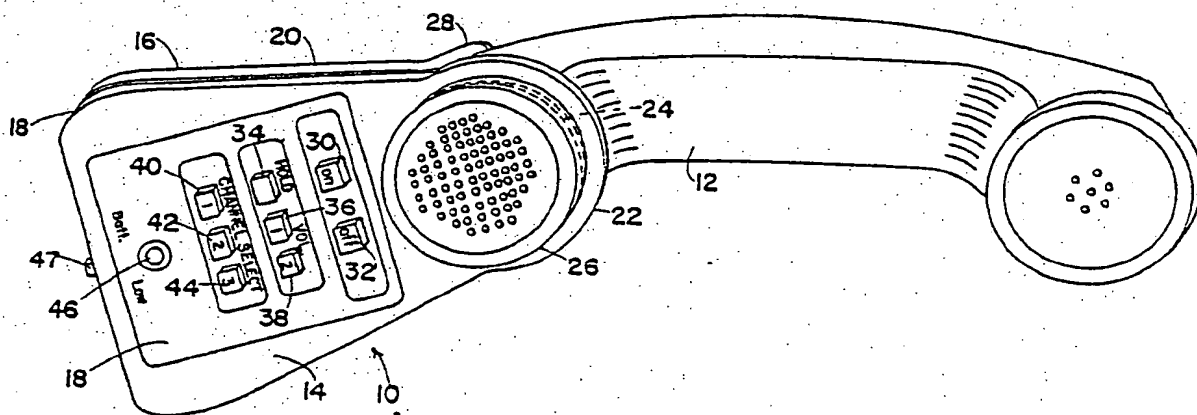


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ³ : H04M 11/00, 15/18	A1	(11) International Publication Number: WO 82/ 03517 (43) International Publication Date: 14 October 1982 (14.10.82)
(21) International Application Number: PCT/US81/01773 (22) International Filing Date: 31 December 1981 (31.12.81) (31) Priority Application Number: 222,159 (32) Priority Date: 2 January 1981 (02.01.81) (33) Priority Country: US (71)(72) Applicant and Inventor: CHARITY III, Herman, T. [US/US]; 221 N. Rengstorff Avenue, Mountain View, CA 94043 (US). (74) Agent: HIGGINS, Willis, E.; Gregg, Caplan & Higgins, 800 Menlo Avenue, Suite 220, Menlo Park, CA 94025 (US).		(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent). Published <i>With international search report.</i> <i>With amended claims.</i>

(54) Title: CORDLESS TELEPHONE SYSTEM



(57) Abstract

This system is for attachment to a conventional telephone handset (12) and console (152). A handset module (10) forms a remote unit in combination with the handset (12) and has a casing (14) with circuit means (fig. 3) in the casing (10). The circuit means (fig. 3) includes a transmitting portion (78) and a receiving portion (80) for audio signals. A means (70) electrically connects the transmitting portion (78) of the circuit means (fig. 3) to a microphone in the telephone handset (12). The electrical connection means (70) also connects the receiving portion (80) of the circuit means (fig. 3) to a headphone of the handset (12). The handset module (10) also includes a means (22) for fastening the casing (14) to the handset (12). A console module (150) forms a base unit of the system in combination with the console (152). The console module (150) incorporates transmitting and receiving circuits (182, 184) and couplers (180) for supplying and receiving signals from the console (152).

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"CORDLESS TELEPHONE SYSTEM"

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a cordless or remote telephone system. More particularly, it relates to a cordless or remote telephone system which attaches to and utilizes a conventional telephone. Most especially, it relates to such a system incorporating improved functionality.

2. Description of the Prior Art

There are a variety of cordless or remote telephones presently on the market. The state of the art in cordless telephones is summarized by, for example, Gilder, "PE Examines Cordless Telephones", Popular Electronics, December 1980, pp. 18-24.

As presently contemplated, such cordless telephones are complete replacements for conventional telephones. That is, they include a base station that connects to the telephone line and conventional household current, and a remote handset, which will receive from and transmit to the base station for distances up to several hundred feet. Most of the known cordless telephones have handsets which resemble a walkie-talkie, and many of them also require pushing a button to talk and releasing the button to listen.

Such considerations tend to limit the use of such cordless telephones to situations in which the remote capability is highly desirable or even necessary. The relatively high cost of such complete replacements for the conventional telephone which must themselves meet telephone company specifications to be attached to telephone lines, also tends to limit their acceptance. The fact that many telephone customers now purchase their



conventional telephone instruments in order to avoid monthly rental charges also means that they are less likely to replace the instruments they own with presently available cordless telephones. Particularly in business offices, such conventional telephone instruments often incorporate features not available on present day cordless telephones.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a cordless telephone system which may be attached to a conventional telephone instrument.

It is another object of this invention to provide a cordless telephone module which attaches to a conventional telephone handset to convert it to a remote unit.

It is another object of this invention to provide such a cordless telephone module incorporating dialing capability.

It is another object of the invention to provide a base module for a cordless telephone system that connects to a conventional telephone console.

These and related objects may be achieved through use of the novel cordless telephone system herein disclosed. A system in accordance with this invention includes a console module that attaches to a conventional telephone console to form a base unit and a remote module which is attached to a conventional telephone handset to form a remote unit.

The combination of the remote module and the telephone handset form a remote unit of the system. The remote module includes a casing and circuit means mounted in the casing, desirably on one or more circuit boards.

The circuit means includes a transmitting portion and a receiving portion for audio signals. A means electrically connects the transmitting portion of the circuit means to a microphone of the handset. The connecting means also connects the receiving portion of the circuit means to a headphone of the handset. The casing includes a means for fastening the casing to the telephone handset.

The console module includes a first coupling means for supplying signals to the telephone console corresponding to signals conventionally supplied by a microphone of a telephone handset connected to the console. A second coupling means receives signals from the telephone console corresponding to signals conventionally supplied to a headphone of a telephone handset connected to the console. A transmitting circuit is connected to receive the headphone signals from the second coupling means and transmit them to a remote unit. A receiving circuit is connected to receive microphone signals from a remote unit and supply them to the first coupling means. The first and second coupling means, the transmitting circuit and the receiving circuit are contained within a casing which has a means for attaching the console module to the telephone console. The console module also desirably includes a connection for charging a battery within the remote unit.

While a remote unit employing the handset module of this invention and a base unit incorporating the console module of this invention may each be used with other types of base units and remote units, respectively, it is preferred to employ both a handset module in accordance with the invention and a console module in accordance with the invention to provide a remote or cordless telephone system. Using the modules in accordance with this invention to convert a conventional telephone to a cordless telephone means that the remote telephone capability may be provided with existing telephones incorporating a wide variety of



additional features, which do not need to be separately provided in a replacement remote telephone. For example, the modules may be used with telephones having a number of lines connected to a single instrument, card dialer telephones, intercom lines, and the like. If desired, one or more satellite units configured to hold a remote unit and incorporating a charging circuit for the battery of the handset module may be provided as well.

The attainment of the foregoing and related objects, advantages and features of the invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the invention, taken together with the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an external perspective view of a handset module in accordance with the invention, installed on a conventional telephone handset;

Fig. 2 is a plan view of the back of the handset module shown in Fig. 1;

Fig. 3 is a block diagram of electrical circuitry for use in the handset module shown in Figs. 1 and 2;

Figs. 4 and 5 are side views of alternative embodiments of the invention, showing their means of attachment to the telephone handset;

Fig. 6 is an external perspective view of a console module in accordance with the invention, attached to a conventional telephone console.

Fig. 7 is a block diagram of electrical circuitry for the console module shown in Fig. 6;

Fig. 8 is a front view of a holder useful for storing the handset module and handset of Figs. 1 and 2;

Fig. 9 is a side view of another embodiment of a handset module in accordance with the invention, installed on a different form of telephone handset.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawings, more particularly to Figs. 1 and 2, there is shown a module 10 for converting a conventional telephone handset 12 to a remote unit of a remote or cordless telephone system. The module 10 has a case 14 consisting of first and second plastic portions 16 and 18 attached on each side of a centrally disposed aluminum or other suitable metal plate 20, which has an integrally formed ring portion 22 dimensioned to fit over the threads 24 on telephone handset 12. Threaded mouthpiece cover 26 is then screwed down on threads 24 to clamp the ring-shaped portion 22 securely to the handset 12. With this configuration, the module 10 has sufficient strength to pass drop tests required for telephone equipment. Portion 28 of the case 14 also extends along handset 12 as shown (see also Figs. 4 and 5) to provide additional support and to conceal wires (not shown) for connecting electrical circuitry contained within the module 10 to be described below in connection with Fig. 3 to a microphone and a headphone contained within the handset 12.

The plastic portions 16 and 18 of the case 14 include various buttons and indicators for control functions of the module 10. Included on portion 18 are buttons 30 and 32 for turning the module 10 on and off, respectively. A hold button 34 causes the module 10 to execute the hold function for a particular call in accordance with standard telephone practice. Volume control buttons 36 and 38 provide a high and low volume selection for the module 10.

Channel select buttons 40, 42 and 44 provide the capability to select from three transmission and receiving channels for the module 10 so that more than one system in accordance with the invention can be used within range of one another, for example, in the same office, without cross talk between systems. If the same channel is selected by such multiple systems within range of one another, a conferencing ability is alternatively provided. A light emitting diode 46 is connected to provide an indication that a battery in the module needs recharging. A charge connector 47 is provided for connecting the battery in module 10 to a charging circuit.

Fig. 2 shows the control functions on the plastic portion 16 of case 14. A conventional Touch Tone ⁽¹²⁾ * telephone keypad 48 provides dialing capability from the module 10. An extra button 50 in Touch Tone keypad 48 provides the capability for automatic redialing of the last number called, particularly useful in the case of a busy line. A four digit liquid crystal display 52 functions both to display time and as a stop watch. Button 54 is provided to set the time shown on display 52. Buttons 56 and 58, used in conjunction with button 54, allow the setting function to be executed slowly or rapidly, respectively. Buttons 60 and 62 control two alarms. The first alarm is used to limit the length of a particular call. The second alarm is used to remind a user that it is time for an important call. Buttons 64 and 66 are used with the setting buttons 54, 56 and 58 to select either hours or minutes for setting.

Figure 3 shows circuitry mounted on a circuit board within case 14 for providing the circuit functions of the module 10. As shown, interface and driver circuits 70 are connected by lines 72 and 74, respectively, to a headphone and a microphone of the telephone handset 12. Line 76 is a common connection for the headphone and

microphone connections. Interface and driver circuits 70 are also connected to a radio frequency (RF) transmitter circuit 78 and an RF receiver circuit 80 by lines 82 and 84, respectively. The transmitter and receiver circuits are each connected to a suitable antenna 86 contained within case 14 by lines 88 and 90 (Fig. 1).

Interface and driver circuits 70 are also connected to Touch Tone generation circuit 92 by line 94 and to on/off hook alternate mode circuit 96 by line 98. The on/off hook circuit 96 is connected to clock circuit 100 by line 102. The Touch Tone generation circuit 92 is connected to random access memory 104 by line 106. The clock circuit 100 is also connected to random access memory 104 by line 108. Random access memory (RAM) 104 is further connected to rate computation microprocessor 110 by a multiplicity of lines, depending on organization of the random access memory. For convenience, microprocessor 10 is therefore shown immediately below RAM 104 without showing the connections separately. The rate computation microprocessor is connected to liquid crystal display 52 by line 114. Clock 100 is also connected to the liquid crystal display 52 by line 116. Power is supplied to the circuits of Fig. 3 by battery pack 118, connected to clock circuit 100 by line 120 and to interface and driver circuits 70 by line 122. In practice, it is preferred to implement the circuits 96, 100, 104 and 110 in a single, commercially available AMCC 1259 type integrated circuit 123, obtainable from Applied Micro Circuits Corporation, Cupertino, California 95014. The microprocessor portion of this circuit is suitably programmed to provide the functions described herein. Alternatively, the circuitry of Fig. 3 may be implemented through use of commercially available telecommunications integrated circuits obtainable, for example from General Instrument Corporation, Hicksville, New York 11802.

In operation, the interface and driver circuits 70 receive input signals representing sounds detected by the microphone of the handset 12 on line 74. Those signals are then level shifted by the circuit 70 and supplied as an input on line 82 to RF transmitter 78 for transmission to the base unit of Figs. 6-7. Correspondingly, signals broadcast by the base unit are supplied as inputs to receiver 80 on line 90, supplied to the interface and driver circuit 70 as an input on line 84, level shifted by the circuit 70 and supplied to the headphone of handset 12 on line 72.

When an incoming call is received at a telephone equipped with the module 10 when handset 12 is in place on its console, a conventional ringing circuit may be employed. Otherwise, a ringing signal is received at RF receiver 80, supplied to interface and driver circuit 70 on line 84, and then supplied on line 117 after level shifting to operate ringing circuit 119. If the handset 12 is in its cradle at the console, the ringing signal is interrupted at the console in the conventional manner when the handset 12 is lifted from the cradle to answer the telephone. In the remote mode of operation, ringing is interrupted by pressing ON button 30 (Fig. 1), causing on/off hook alternate mode circuit 96 to supply a signal on line 98 for that purpose. A corresponding signal must also then be sent by RF transmitter 78 to the base unit to terminate ringing at the console. The ringing interrupt signal is also supplied on line 102 to clock 100 for use in timing a call if that function of the module is utilized. OFF button 32 is pressed at the conclusion of the call to disconnect at the console via a signal from transmitter 78 and turn off module 10.

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Similarly, when a call is placed, dialing may be carried out in the conventional manner from the console. When the handset 12 is away from the console and it is desired to place a call, the ON button 30 is depressed to actuate the on/off hook circuit 96, and a signal is sent by transmitter 78 to the base module. The base module then sends a dial tone signal back to receiver 80 to indicate that dialing may commence. The Touch Tone keypad 48 is employed in a conventional manner to dial a desired number, with the appropriate signals being furnished on line 94 to the interface and driver circuits 70 for transmission on line 82 to transmitter 78, and thence to the base module. The Touch Tone signals are also supplied on line 106 to RAM 104 for use in rate computation, if that function of the system is utilized. Termination of ringing at the desired number is sensed at the console in a conventional manner, that information is conveyed to receiver 80 by the base unit, then through interface and driver circuits 70 and line 98 to on/off hook circuit 96 for supply of a signal on line 102 to clock 100 for timing control, if that function is utilized. An appropriate signal on line 108 also controls rate computation by microprocessor 110. When the AMCC 1259 type integrated circuit is used, an additional feature of that circuit allows up to three most commonly used 10-digit telephone numbers to be stored in RAM 104 by pressing button 51 and a code location (i.e., 01, 02 or 03) prior to dialing the number. The number is then stored in RAM 104 until altered, and can be redialed automatically by pushing redial button 50 and the desired code location.

The rate computation function is carried out by storage of the most commonly used area codes and their corresponding rates from the calling area code in RAM 104 through use of Touch Tone keypad 48. When one of those numbers is subsequently dialed, total charges for the call are calculated by the microprocessor 110 based on the time of the call. Through storage of variable rate information

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for different times of the day in accordance with established telephone company tariffs, the computation may be made automatically for varying rate charges as well.

Fig. 4 shows an alternate mode for fastening the handset module 10 to the handset 12. In this embodiment, plastic portion 130 of the module has an integrally formed mouthpiece cover 132 at one end. The integrally formed mouthpiece cover 132 has mating threads 133 for the threads 24 of handset 12. With this embodiment, the entire module 12 is rotated to screw the integral mouthpiece cover 132 onto handset 12. This embodiment also shows use of a conventional modular telephone connector 134, which is passed through apertures 136 and 137 to connect the module 10 to handset 12. The operation of the remote module in Fig. 4 is the same as the module of Figs. 1-3.

Fig. 5 shows an alternative embodiment of the invention, in which a commercially available Soft Touch ^(R) tone dial 140, obtainable from Buscom Systems, Incorporated, Santa Clara, California 95050 is employed to provide dialing capability. The Soft Touch tone dialer 140 replaces a conventional mouthpiece for the handset 12. With this form of the invention, the module 10 only has the function buttons shown in Fig. 1. It should also be noted that a conventional wire harness 142 has been employed to connect the module 10 to microphone 144 and headphone 146 of the handset 12. Otherwise, the construction and operation of the Fig. 5 embodiment is the same as those of Figs. 1-4.

Fig. 6 shows an external view of a base module 150 in accordance with the invention installed on a conventional desk telephone console 152. The module 150 includes a case 154 having a pair of clips 156 for mounting the case 154 against the side of the console 152 as shown by clamping it from the bottom of the console. The base module 150 is connected to the telephone line through

input 158, connected to telephone wall jack 160 or other form of conventional telephone line. Connection 162 then connects the module 150 to the usual telephone line input 164 on the console 152. Such an alteration of the normal telephone hookup is necessary in order to give the remote module 10 of this invention on/off hook capability. Connector 166 of the console module 150 is connected to the usual handset connection of the console 152. Connector 168 of the console module 150 is connected to a 115 volt alternating current to direct current converter 170 to charge rechargeable batteries in the module 150.

Fig. 7 shows the circuitry of the console module 150. Interface and drive circuits 180, RF transmitter 182 and RF receiver 184 function in essentially the same manner as the corresponding elements in the handset module circuits of Fig. 3, and their operation will therefore not be repeated here. The handset connection to connector 166 of the console module 150 couples the handset connection of console 152 through transformer windings T1 and T2 to the interface and drive circuits 180. This form of coupling is employed so that the transformer windings can duplicate the impedance characteristics of the handset microphone and headset to which the handset connection is connected in a conventional telephone.

Telephone wall jack 160 is connected through connector 158 to on/off hook circuits 186 of the module 150, which are connected by line 188 to interface and drive circuits 180 to allow transmission and receipt of on/off hook signals and ringing signals to the remote module 10. The on/off hook circuits 186 are also connected through connector 162 to connection 164 of the console 152 to allow operation of the on/off hook and ringing circuits of the module 152 in the conventional manner. Rechargeable battery 190 provides power input to the console module 150 on line 192. Connection 168 is provided to the AC/DC

converter 170 for charging the battery 190. Alternatively, the interface and drive circuits 180 could be directly connected to an AC/DC converter 170, if it is not desired to use a rechargeable battery 190.

Figure 8 shows a satellite unit 200 incorporating a cradle 202 configured to receive handset 12 and remote unit 10 when not in use. A charging circuit including 115 volt alternating current to direct current converter 204 mounted inside casing 206 is provided to charge the battery of module 10 via connector 47 and cable 208, plugged into a corresponding connector (not shown) in cradle 202 when LED 46 (Fig. 1) shows that the battery is low. Several of the satellite units 200, handsets 12 and modules 10 may be used with a single console module 150 to provide remote extension telephone capability in strategic locations of a house or office.

Fig. 9 shows another embodiment of a handset module 210 for use with a Trimline ^(R)* telephone handset 212. Casing 214 has a clamp-shaped portion 216 which engages mouthpiece 218 along its sides 220 and top 222 to fasten the module 210 rigidly to mouthpiece 218.

It should now be apparent to those skilled in the art that a modular telephone system capable of achieving the stated objects of the invention has been provided. The handset module and console module of this invention may respectively be attached to handsets and consoles of existing telephones in order to convert them to remote or cordless capability. This means that it is not necessary to replace existing telephones with an entire cordless telephone system in order to obtain cordless operation.

It should further be apparent to those skilled in the art that various changes in form and detail of the invention are shown and described in the above embodiments

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may be made. For example, the control buttons shown in Figs. 1-2 could have raised Braille patterns on their faces to facilitate use of the system by the visually handicapped. The console module may also be provided in a hollow casing containing its electronics, shaped to fit over the telephone console, and configured to resemble a book or other ornamental object. It is intended that such changes be included within the spirit and scope of the claims appended hereto.

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CLAIMS

1 1. A module for attachment to a telephone
handset including a headphone and a microphone, which
comprises:

- 5 a) a casing,
b) a circuit means having a transmitting
portion and a receiving portion for audio signals mounted
in said casing,
c) means for electrically connecting the
10 transmitting portion of said circuit means to the micro-
phone of the handset and the receiving portion of said
circuit means to the headphone of the handset, and
d) means for fastening said casing to the
handset.

1 2. The module of Claim 1 in which the handset
has screw threads and said fastening means comprises a
ring-shaped portion of said casing dimensioned to fit over
the screw threads and be clamped to the handset by a member
5 having mating screw threads for the screw threads of the
handset.

1 3. The module of Claim 1 in which the handset
has screw threads and said fastening means comprises
mating screw threads on said casing for the screw threads
on the handset.

1 4. The module of Claim 1 in which said fasten-
ing means comprises a clamp portion of said casing
dimensioned and configured fixedly to engage a mouthpiece
portion of the handset.

1 5. The module of Claim 1 in which the trans-
mitting portion of said circuit means generates signals
intelligible by a telephone system as selected numbers
and said module additionally comprises means connected to
5 the transmitting portion of said circuit means for select-
ing numbers for which corresponding signals are to be
generated.

1 6. The module of Claim 1 in which said circuit
means includes a timing portion.

1 7. The module of Claim 7 in which said circuit
means further includes a charge computation portion connec-
ted to the timing portion.

1 8. A console module for a remote telephone
system, which comprises:

5 a) first coupling means for supplying signals
to a telephone console corresponding to signals convention-
ally supplied by a microphone of a telephone handset
connected to the console,

10 b) second coupling means for receiving signals
from the telephone console corresponding to signals
conventionally supplied to a headphone of a telephone hand-
set connected to the console,

 d) a receiving circuit connected to receive
microphone signals from a remote unit and supply them to
said first coupling means.

1 9. A remote telephone system, which comprises a
handset module in accordance with Claim 1 and a console
module in accordance with Claim 8 each respectively
connected to a telephone handset and a telephone console.

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- 1 10. The remote telephone system of Claim 9 further including at least one satellite unit configured to hold said handset module and said handset and including a charging circuit for a battery in said handset module.

AMENDED CLAIMS

(received by the International Bureau on 15 June 1982 (15.06.82))

- 1 (amended) 1. A cordless telephone including circuit
means with a transmitting portion and a receiving portion
for audio signals, characterized by a module for attach-
ment to a telephone handset including a headphone and a
5 microphone to convert the handset to cordless operation,
which comprises:
- a) a casing, said circuit means being mounted in
said casing,
 - 10 b) means for electrically connecting the
transmitting portion of said circuit means to the micro-
phone of the handset and the receiving portion of said
circuit means to the headphone of the handset, and
 - c) means for fastening said casing to the
handset.
- 1 (amended) 2. The module of Claim 1 further characterized
in that the handset has screw threads and said fastening
means comprises a ring-shaped portion of said casing
dimensioned to fit over the screw threads and be clamped
5 to the handset by a member having mating screw threads
for the screw threads of the handset.
- 1 (amended) 3. The module of Claim 1 further characterized
in that the handset has screw threads and said fastening
means comprises mating screw threads on said casing for
the screw threads on the handset.
- 1 (amended) 4. The module of Claim 1 further characterized
in that said fastening means comprises a clamp portion of
said casing dimensioned and configured fixedly to engage
a mouthpiece portion of the handset.

1 5. The module of Claim 1 in which the trans-
mitting portion of said circuit means generates signals
intelligible by a telephone system as selected numbers
and further characterized in that said module additionally
5 comprises means connected to the transmitting portion of
said circuit means for selecting numbers for which
corresponding signals are to be generated.

1 6. The module of Claim 1 in which said circuit
means includes a timing portion.

1 7. The module of Claim 7 in which said circuit
means further includes a charge computation portion connec-
ted to the timing portion.

1 (amended) 8. A remote telephone system, characterized by
including a console module for the remote telephone system
for connection to a telephone console for allowing the
telephone console to operate with a remote handset, which
5 comprises:

a) a first coupling means for supplying signals
to a telephone console corresponding to signals conven-
tionally supplied by a microphone of a telephone handset
connected to the console,

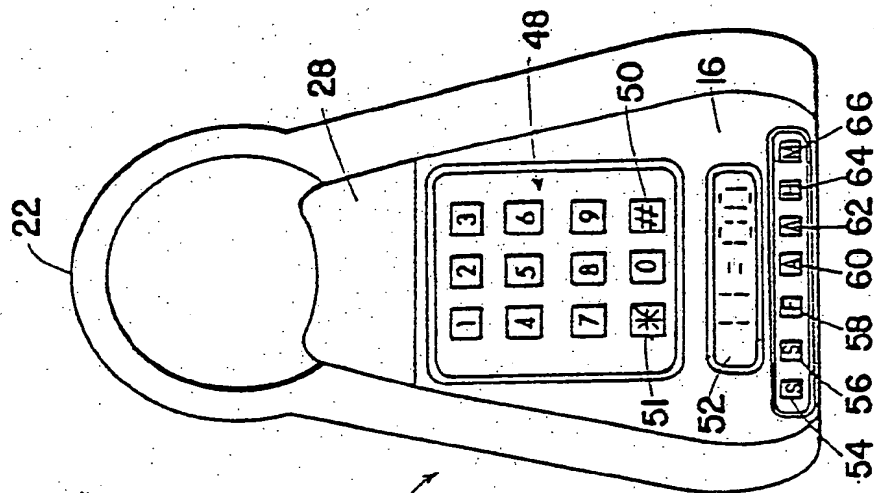
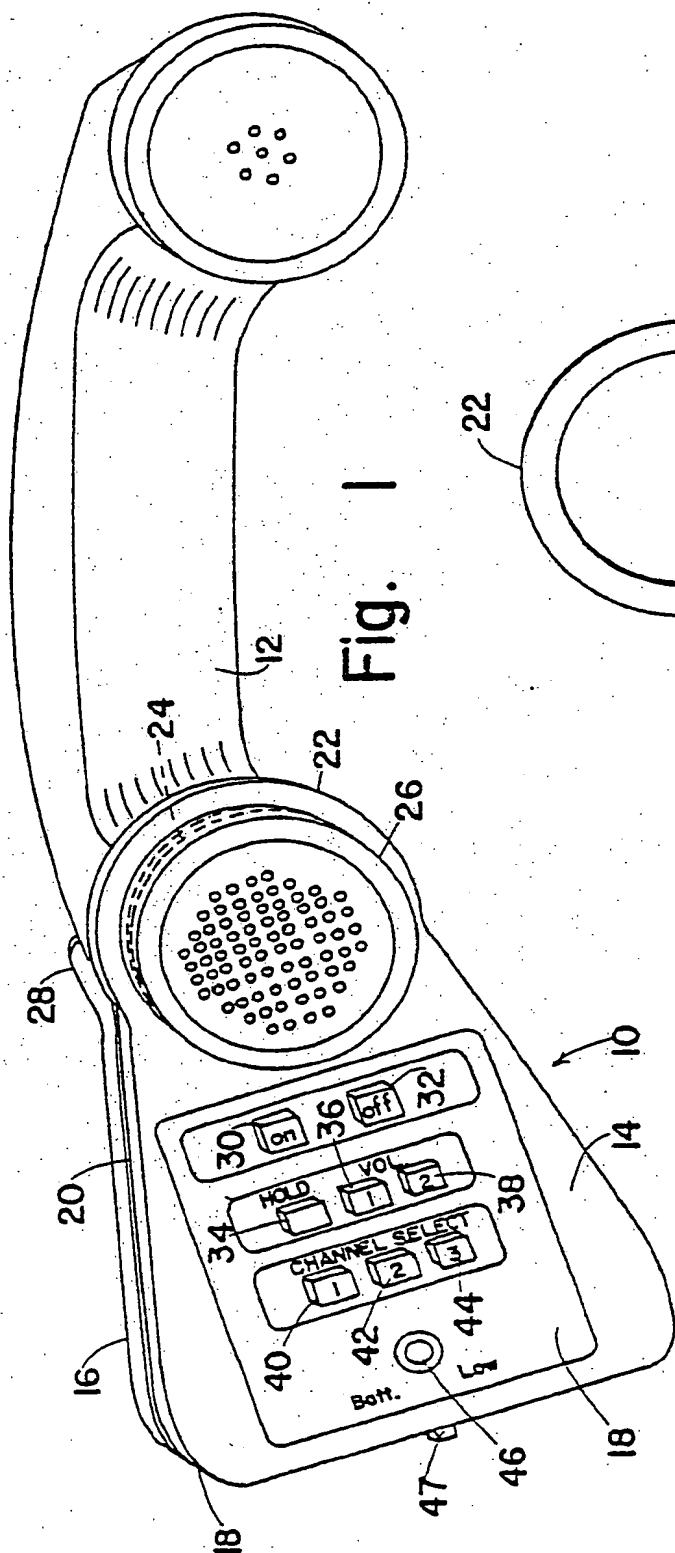
10 b) second coupling means for receiving signals
from the telephone console corresponding to signals
conventionally supplied to a headphone of a telephone hand-
set connected to the console,

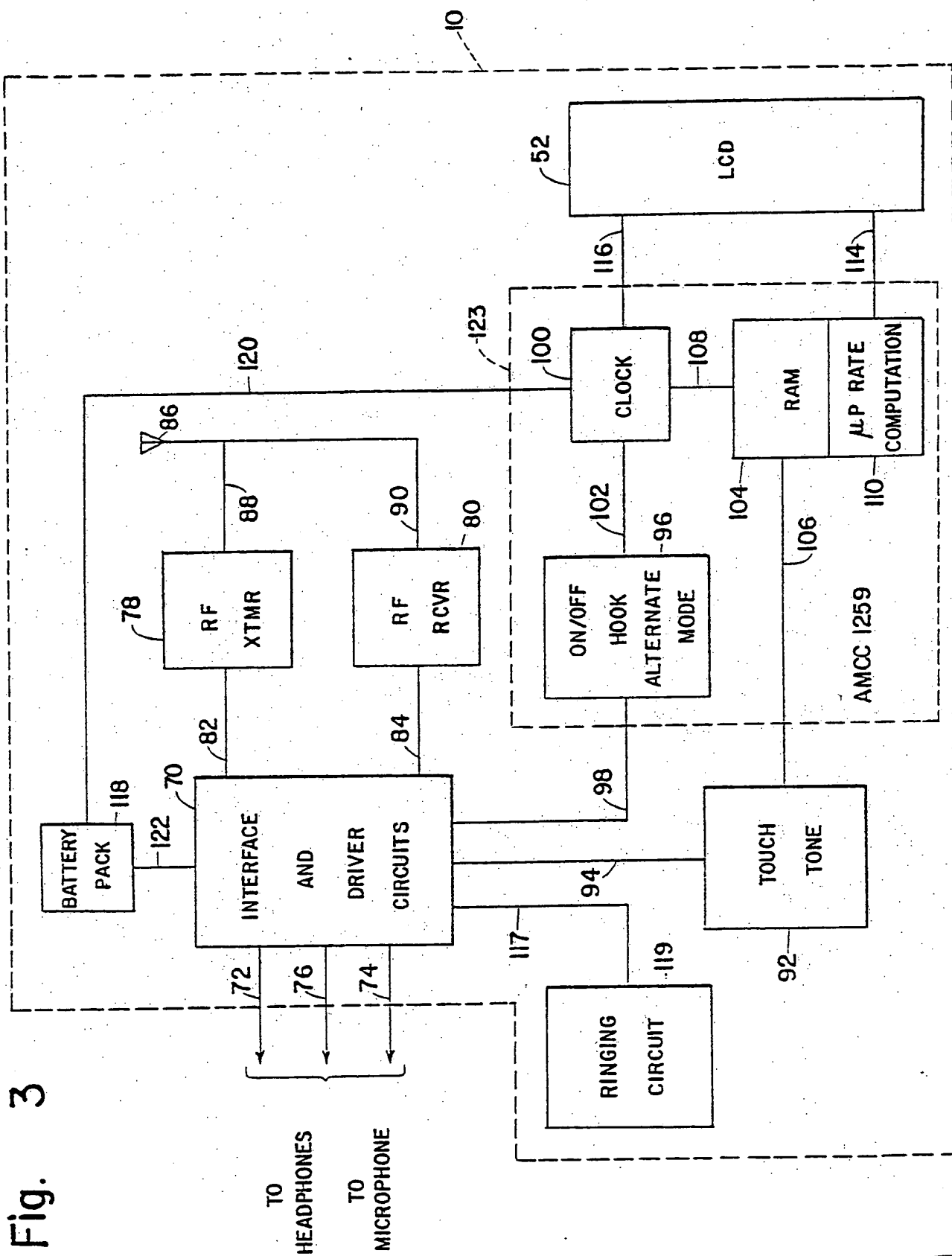
15 c) a receiving circuit connected to receive
microphone signals from a remote unit and supply them to
said first coupling means.

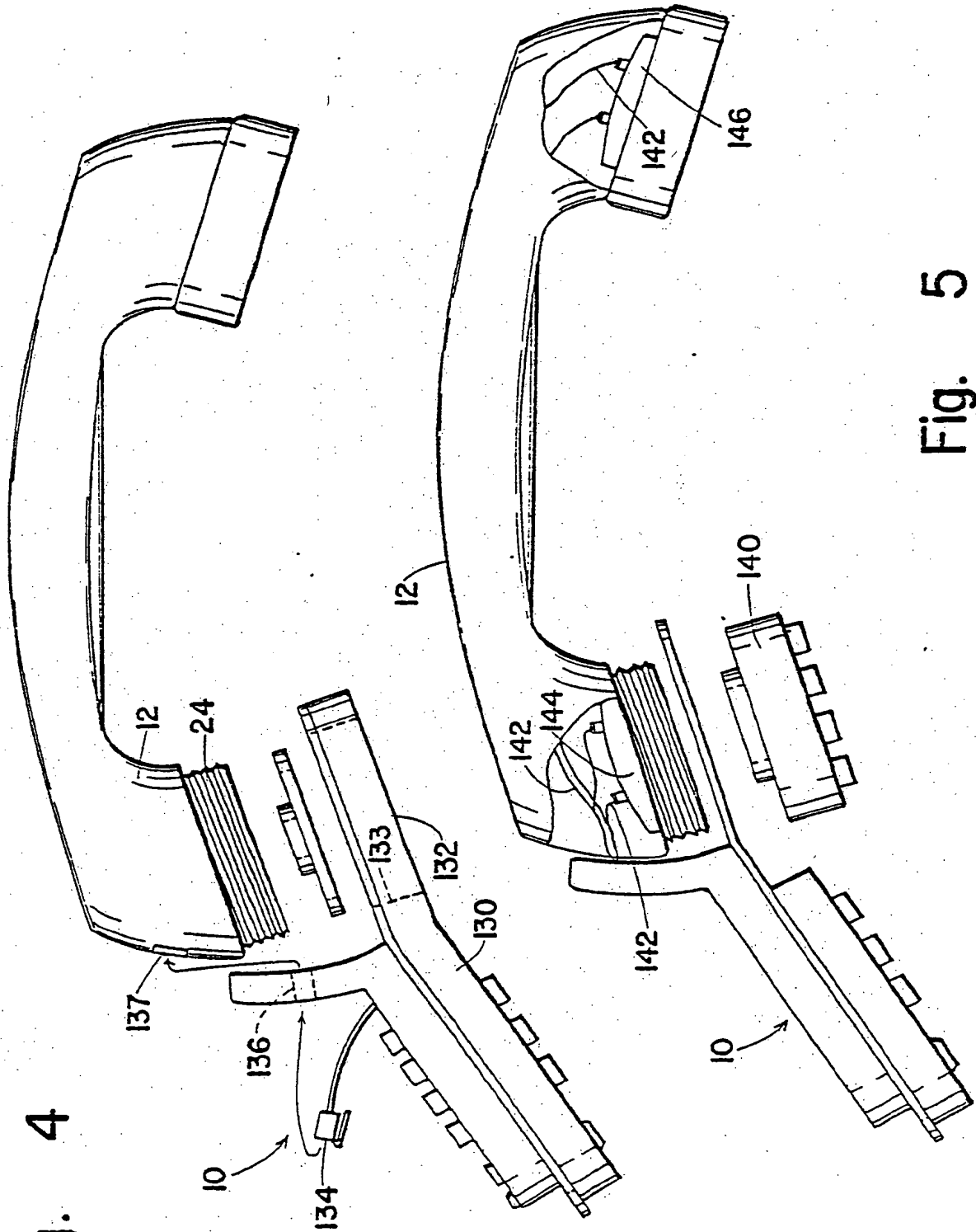
1 9. A remote telephone system, characterized by
a handset module in accordance with Claim 1 and a console
module in accordance with Claim 8 each respectively
connected to a telephone handset and a telephone console.

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10. The remote telephone system of Claim 9 further characterized by including at least one satellite unit configured to hold said handset module and said handset and including a charging circuit for a battery in said handset module.







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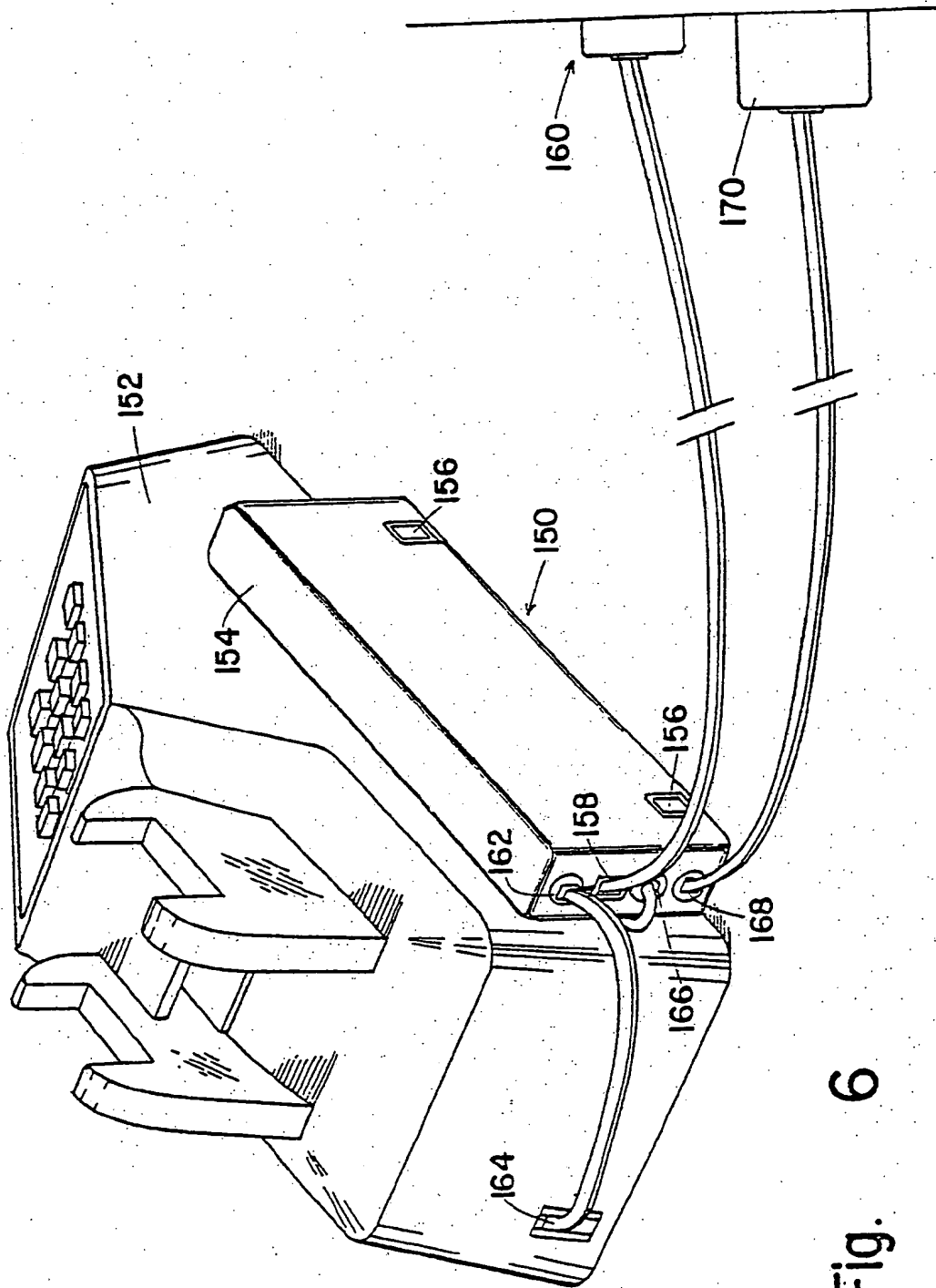
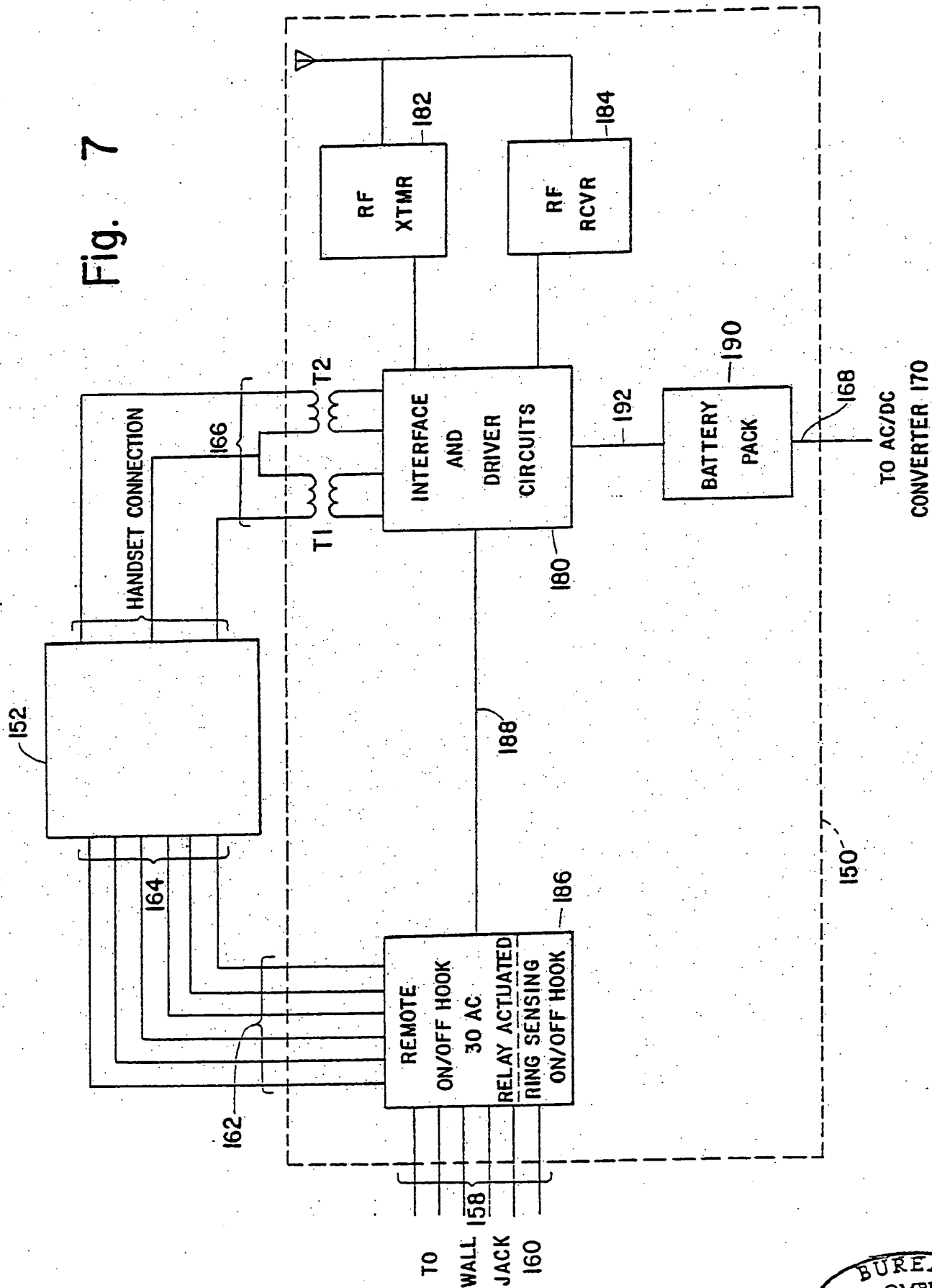


Fig. 6

Fig. 7



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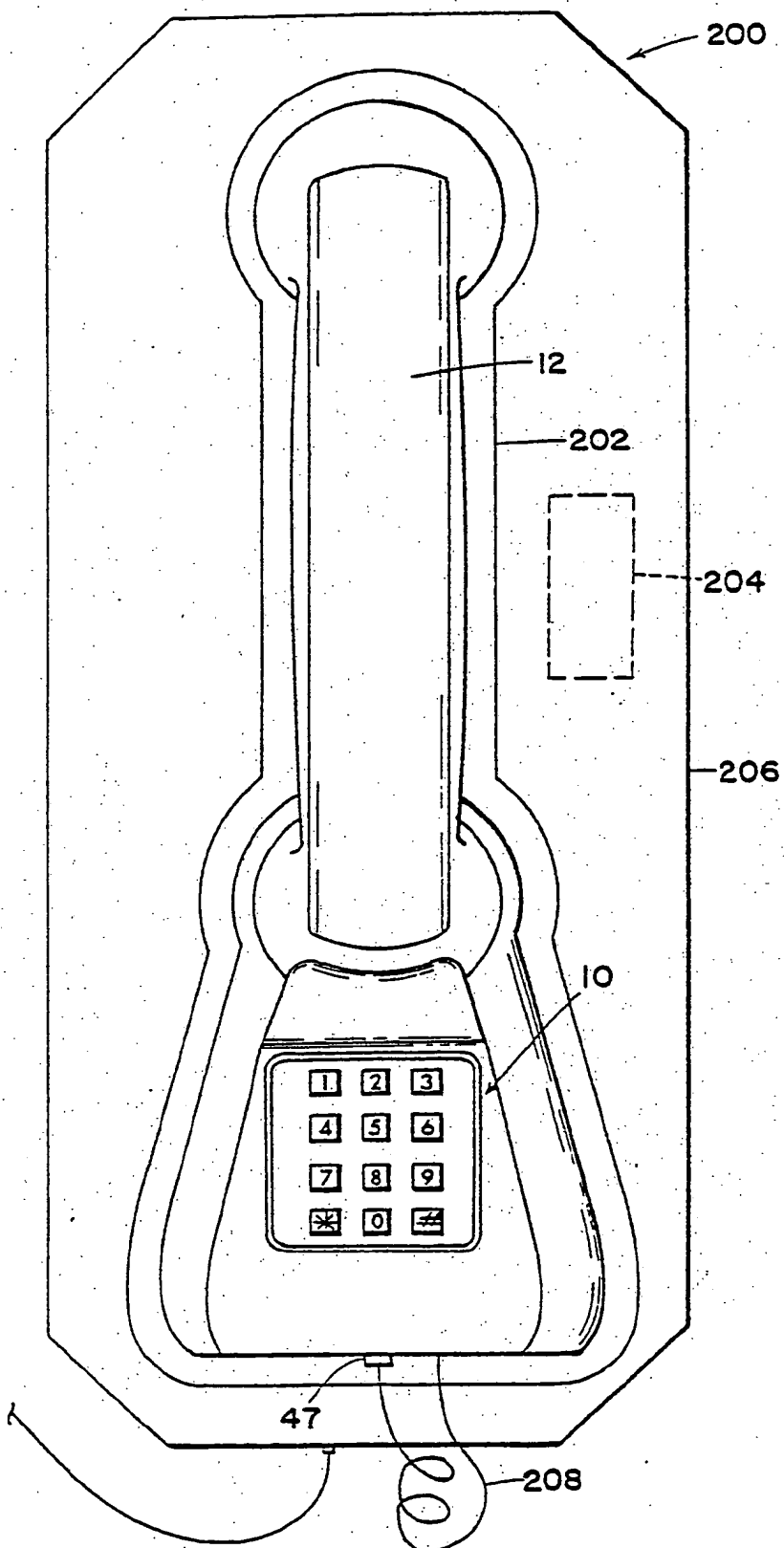


Fig. 8

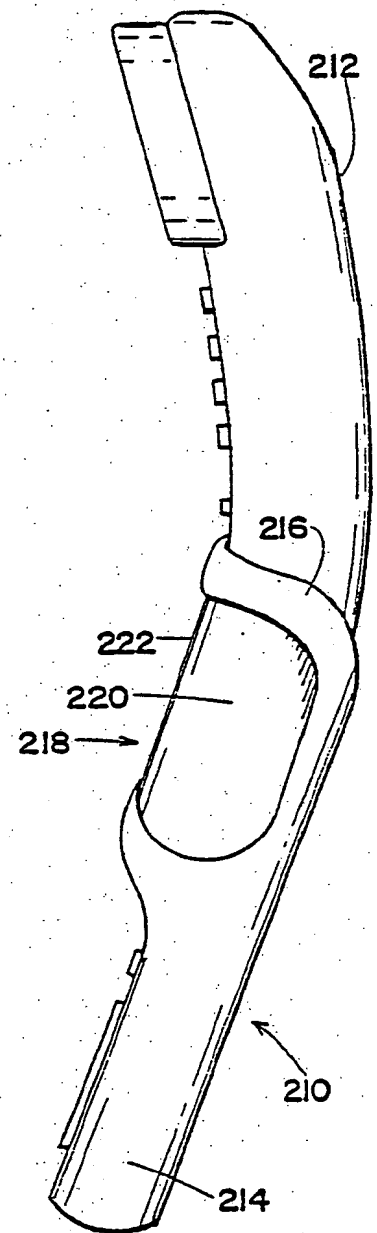


Fig. 9

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US81/01773

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ³ According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; margin-top: 5px;"> INT CL ³ H04M 11/00, 15/18 U.S. CL. 179/2EA, 7.1R </div>																				
II. FIELDS SEARCHED <div style="text-align: center; margin-top: 5px;"> Minimum Documentation Searched ⁴ </div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td style="width: 20%; padding: 5px;">Classification System</td> <td style="padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px; text-align: center;">U.S.</td> <td style="padding: 5px;">179/2E, 2EA, 2TC, 7.1R</td> </tr> </table> <div style="text-align: center; margin-top: 10px;"> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵ </div>			Classification System	Classification Symbols	U.S.	179/2E, 2EA, 2TC, 7.1R														
Classification System	Classification Symbols																			
U.S.	179/2E, 2EA, 2TC, 7.1R																			
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴ <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width: 10%; padding: 5px;">Category [*]</th> <th style="width: 70%; padding: 5px;">Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷</th> <th style="width: 20%; padding: 5px;">Relevant to Claim No. ¹⁸</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">X</td> <td style="padding: 5px;">DE, A, 1,930,531, Published 23 December 1970</td> <td style="text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="text-align: center; padding: 5px;">X</td> <td style="padding: 5px;">DE, A, 1,930,532, Published 23 December 1970</td> <td style="text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="text-align: center; padding: 5px;">X</td> <td style="padding: 5px;">US, A, 4,039,760, Published 02 August 1977, Gregory et al.</td> <td style="text-align: center; padding: 5px;">8</td> </tr> <tr> <td style="text-align: center; padding: 5px;">X</td> <td style="padding: 5px;">US, A, 4,053,717, Published 11 October 1977, Snider.</td> <td style="text-align: center; padding: 5px;">5</td> </tr> <tr> <td style="text-align: center; padding: 5px;">X</td> <td style="padding: 5px;">US, A, 4,122,308, Published 24 October 1978, Weinberger et al</td> <td style="text-align: center; padding: 5px;">6,7</td> </tr> </tbody> </table>			Category [*]	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸	X	DE, A, 1,930,531, Published 23 December 1970	1	X	DE, A, 1,930,532, Published 23 December 1970	1	X	US, A, 4,039,760, Published 02 August 1977, Gregory et al.	8	X	US, A, 4,053,717, Published 11 October 1977, Snider.	5	X	US, A, 4,122,308, Published 24 October 1978, Weinberger et al	6,7
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </div> <div style="width: 45%;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p> </div> </div>																				
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